The JOURNAL of GEOGRAPHY

A Monthly Magazine Devoted to the Interests of Teachers of Geography in Elementary, Secondary, and Normal Schools.

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Of the Department of Geology and Geography at the University of Wisconsin

VOLUME XIV SEPTEMBER 1915 NUMBER 1

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$1.00 a Year **THE JOURNAL OF GEOGRAPHY** 15c a Copy

V. C. FINCH, Business Manager

University of Wisconsin, Madison, Wis.

Entered at the Post Office, Madison, Wis., as Second Class Mail Matter Sept. 9, 1910

The Journal of Geography

Published Monthly Except July and August

Successor to the Journal of School Geography, Vol. V, and the Bulletin of the American Bureau of Geography, Vol. II.

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PRICE—The subscription price is one dollar a year, payable in advance. Fifteen cents a copy.

POSTAGE IS PREPAID by the publisher for all subscriptions in the United States, Hawaiian slands, Philippine Islands, Guam, Porto Rico, Tutuila and Samoa. Add 10 cents postage for Mexico and Canada. For all other countries in the Universal Postal Union add forty cents for postage.

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The JOURNAL of GEOGRAPHY

Volume XIV SEPTEMBER 1915 Number 1

THE MONEY VALUE OF RAINFALL IN SELECTED CROP AREAS OF THE UNITED STATES*

By E. J. Cragoe
Graduate Student in Geography, University of Wisconsin

Introduction

THE two great cereal crops of this country are corn and wheat. Over one hundred million acres are sown to corn annually, which produce a crop of about two and one-half billion bushels. An area about half as great is sown to wheat each year, which yields a crop of approximately eight hundred million bushels. The average value of these two crops alone is over two billions of dollars; that of corn being somewhat more than twice that of wheat.

A sufficient amount of moisture is, of course, essential to any crop. Were the moisture conserved the year round, a mean annual rainfall of 11 inches would be adequate in the northern part of the Great Plains, as in a similar region in Russia good crops are grown. The water required to mature 1 pound of dry matter in wheat is from 200 to 500 pounds in moist climates; from 325 to 500 pounds in Wisconsin; and about 750 pounds in Utah and similar dry climates. This means that a rainfall of 4 to 5 inches will produce a crop in dry climates *if all is conserved*. With proper care about half of the moisture can be retained for use by the growing crop. Indeed in Utah, crops have been grown for 30 years, without irrigation, on a mean annual rainfall of 14.5 inches and in places even less.

The variety of wheat grown influences the yield greatly, especially in times of drought. In Western Dakota in 1904, it was exceptionally dry. The hard spring variety of wheat, "Pedigreed Bluestem," fell to 11.8 bushels, but the "Kubanka" variety of durum wheat yielded 23.5 bushels per acre.

In general it may be stated that Mediterranean climates require less rainfall to produce crops than Continental climates. It is in the Mediterranean climate of California that wheat is grown without irrigation with the least rainfall of any place in the United States. Here crops are grown where the mean precipitation is only 10.3 inches, while on the edge of the Great Plains in Kansas, 19.8 inches are needed.

It is possible, upon the basis of results obtained, to make some fairly accurate predictions with regard to future wheat and corn yields in the various regions studied.

*This article is an abridgment of a portion of a thesis submitted for the degree of M.A. at the University of Wisconsin in June, 1915.

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RELATION BETWEEN WHEAT YIELD AND RAINFALL IN REGIONS OF LOW RAINFALL

It was found that there is a close relationship between rainfall and wheat yield in regions having a *low* rainfall during the growing season. The following discussion is an attempt to express this relationship in definite mathematical form.

(1) *Relation of the average yield of wheat to the average rainfall in North Dakota.* The study covering the last two decades, shows that, during the three best years, 1902, 1905, and 1912, an average of 7 inches of rainfall yielded an average of 18.3 bushels of wheat per acre; that the three poorest years, 1900, 1910, and 1911, with an average rainfall of 3.6 inches, yielded 6.2 bushels per acre; and that the sixteen medium years, with an average of 6.1 inches of rain, yielded 12.2 bushels per acre. It is thus apparent that the average yield per acre is practically twice the May and June rainfall (in inches); that it is somewhat more than twice the rainfall in extra good years, and somewhat less than twice in the poorest years.

(2) *Relation of the average rainfall to the average wheat yield in South Dakota.*

The six poorest years, 1911, 1904, 1900, 1897, 1894, and 1893, gave an average of 7.2 bushels of wheat with a rainfall of 4.4 inches. The four best years, 1912, 1909, 1905, and 1903, gave 14.0 bushels per acre with 7.6 inches of rainfall. The 12 medium years gave 12.5 bushels with 7.4 inches of rain.

The average yield of wheat in this state is thus but 1.7 times the May and June rainfall.

(3) *Relation between the wheat yield and the average rainfall of the wheat districts in California.* In the wheat regions of California, the four best years, 1872, 1880, 1884, and 1906, produced an average of 18.9 bushels of wheat with an average rainfall in the region (reckoned from that at Sacramento), for the months of January, February, March, and April, of 18.9 inches.

In the six poorest years, 1870, 1871, 1885, 1898, and 1905 (see Table 5), an average of 6.7 inches of rain gave 8.1 bushels of wheat; while in the 32 medium years an average of 11.9 inches of rain yielded 12.6 bushels of wheat.

Thus in the best years,—i. e. those years which yielded over 17 bushels per acre,—the average yield was identically the same as the average rainfall for the months of January, February, March and April.

In the poorest years,—i. e. those years with a yield of less than 10 bushels per acre,—the average yield was about 1.2 times the average total rainfall for the four critical months.

In average or medium years, the yield was but slightly greater than the average total rainfall during the critical months.

(4) *Relation between the average wheat yield and the rainfall of the wheat regions, in Washington.* In the state of Washington, the wheat yield averages almost exactly 4 times the average rainfall in the three chief wheat-growing counties, Whitman, Lincoln and Adams, during the four months of January, February, March and April. It is slightly greater (4¼ times the rainfall) in the best years, and considerably less in the poorest years (2½ times the rainfall).

(5) *Relation between the wheat yield and the rainfall in Kansas and Nebraska.* Here the four poorest years yielded 9.3 bushels of wheat per acre, with an average of 5.28 inches of rainfall during the months of March, April and May. The thirteen medium years gave 14.4 bushels with 7.9 inches of rain. The six best years gave 16.9 bushels with 8.1 inches of rain.

Thus, the average yield was slightly less than twice the rainfall for the three critical months both in the poorest years and in average years, and slightly greater than twice in the best years.

Relation Between Rainfall and Wheat Yield in States With Abundant Rainfall

1. A comparison of the rainfall during May and June, in the state of Minnesota, for years with large yields and those with poor yields is quite significant.

The four poorest years, 1893, 1900, 1906, and 1911, gave an average of 10.3 bushels per acre with an average rainfall of 6.15 inches. The four best years gave 18.35 bushels per acre with an average rainfall but slightly less than that which returned the poorest yields (6.05 inches).

These results indicate that there is no direct relation between the average rainfall and the wheat yield in this state. Hence it is not possible to predict the wheat crop for any series of years upon the single basis of total rainfall for any period.

(2) *Relation between the rainfall and the wheat yield in Ohio, Indiana, Illinois and Missouri.* Here the relation between wheat yield and rainfall is much the same as in Minnesota.

That no definite mathematical relation exists between the wheat crop of states having an abundant rainfall, and the precipitation during the growing season is evident. The results in all cases indicate, however, that the best crops can be expected when the rainfall is below the normal amount during the critical months of the growing season.

Relation of Rainfall to Corn Yield

(1) *Relation of rainfall to corn yield in Ohio.*

(a) The seven best years, 1855, 1872, 1874, 1896, 1900, 1906, and 1912, yielded an average of 41.3 bushels of corn with an average rainfall during July of 5.7 inches.

(b) The eleven poorest years, 1854, 1856, 1858, 1859, 1863, 1867, 1883, 1890, 1893, and 1901, gave 27.5 bushels with 2.8 inches of rain.

(c) The average or medium years with 4.1 inches of rain, gave 34.4 bushels of corn per acre.

Thus the average yields and the best yields are 8.2 times the July rainfall in inches, and the poorest yields are about 10 times the rainfall for this month.

(2) *Relation of rainfall to corn yield in Kansas.* In Kansas, the six poorest years gave 11.9 bushels per acre with 1.82 inches of rainfall. The six best years gave 29.4 bushels with 4.5 inches of rain; and the fifteen medium years gave 21.8 bushels with 4.22 inches of rain.

Thus in average years the yield of corn here is about 5 times the July rainfall, while in the best and poorest years it is 6½ times the rainfall for this month.

(3) *Relation of rainfall to corn yield within the entire Corn Belt.* The yield of corn for the entire "Corn Belt" can be predicted with considerable accuracy from an analysis of the yield and rainfall of past years.

The five poorest years throughout this belt gave an average of 21 bushels of corn per acre with an average rainfall of 2.2 inches for the month of July.

The five best years gave 34.6 bushels per acre with an average of 4.8 inches of rain.

The seventeen medium years gave 31.2 bushels with an average rainfall of 3.9 inches.

Thus in average years, the yield of corn throughout the corn belt was approximately 8 times the July rainfall. In the best years, however, the yield was only 7 times the rainfall for this month, and in the poorest years it was 10 times as great.

VALUE OF VARIOUS AMOUNTS OF RAINFALL TO THE CHIEF WHEAT- AND CORN-PRODUCING STATES

By a proper arrangement of the data obtained, it is possible to show the approximate money value of different amounts of rainfall to each crop within certain areas. Of course, such evaluations are of value only in so far as the yield of the area dealt with depends upon rainfall.

(1) *Value of rainfall to South Dakota.* From the data available the following results are obtained:

The average yield of wheat where the rainfall for May and June was from 3 to 4 inches was 8.9 bushels;

with a rainfall of 6—7 inches, the yield was 12.1 bushels;
with a rainfall of 7—8 inches, the yield was 12.5 bushels;
with a rainfall of 8—9 inches, the yield was 12.3 bushels;
with a rainfall of 9—10 inches, the yield was 13.1 bushels.

The average difference in yield for each inch of rainfall for amounts between 3 and 10 inches is 0.8 bushels per acre.

The average acreage of wheat in South Dakota from 1891-1912 has been 3,000,000 acres. The average price of wheat here has been $0.60 per bushel. The acreage in 1915 was about 4,000,000 acres and the price about $1.20 per bushel.

Combining the above data, gives the *average value of one inch of rainfall,* during May and June, to the wheat-growers of South Dakota, as 3,000,000× 0.8×$0.60 or $1,440,000.

The difference in value between a 3 to 4-inch rainfall and a 6 to 7-inch fall was $5,760,000.

The difference in value of the crop in years when the rainfall averaged less than 5 inches and when it was more than 5 inches was $6,840,000.

The value of an inch of rainfall to this state in 1915 was somewhat over $3,800,000 for the wheat crop alone.

(2) *Value of rainfall to North Dakota.*

A similar series of computations for North Dakota shows that the average increase in yield has been 1.2 bushels per acre for each inch of rainfall above 4 inches; that is, the average value of one inch of rainfall to the wheat-farmers of North Dakota is $3,350,000.

The difference in value of the crop in years with a rainfall less than 5 inches and in years when it was over 5 inches was $10,000,000.

(3) Similar computations show that in California each inch of rain during the four months included in January to April was valued at about $1,500,000. The difference between a 6.7 inch rainfall and a 19 inch rainfall in those four months amounted to about $18,000,000.

(4) *Total value of one inch of rainfall to the six states of North Dakota, South Dakota, California, Washington, Kansas, and Nebraska.* The total value of one inch of rainfall during the critical period in ordinary years, to these six states is approximately $15,000,000 for the wheat crop alone. During 1915 due to war prices this inch of rainfall was worth about $25,000,000 to these states.

Value of Rainfall to Corn-Producing States

In the preceding paragraphs, there was found to exist a close dependence of corn yield upon rainfall, throughout the entire corn belt. It is a fact worth noting that in this belt the highest average yield of corn per acre is in the state (Ohio) having the highest average rainfall during the critical month of July. Furthermore, the other states follow in order of both decreasing rainfall and yield;—Indiana, Illinois, Iowa, Nebraska, and finally Kansas, in the order given. Within this belt it is possible to estimate the value of various amounts of rainfall with a considerable degree of accuracy. The larger the area considered, the greater the accuracy of the estimate. Computations were

made for each of the states of the corn belt, but only results for the belt as a whole are here given.

An excess of rainfall in July has always been followed by a large corn crop when the entire corn belt is considered, whereas a deficiency during July has almost always caused a short crop. The correlation between rainfall and corn yield here is very close and the following results should be correspondingly accurate.

When the July rainfall has averaged from 2 to 3 inches over this entire belt, the average corn yield has been 23.2 bu. per acre. When the rainfall was from 3 to 4 inches, the yield was 29.7 bu. per acre. When the rainfall was 4 to 5 inches the yield per acre averaged 32.5 bushels. For those years when the rainfall for July averaged ½ inch below normal or less, the yield has been 23 bu. per acre. When the rainfall averaged ½ inch or more above normal during this critical month, the yield has been 33 bu. per acre.

The average area devoted to corn in this belt is about 50,000,000 acres. The average price received by the farmer for his corn is about $0.50 per bushel. One inch of July rainfall above 3 made a difference of 6.5 bu. per acre in the corn yield. This means a difference of $160,000,000 for this inch of rain.

One inch of rainfall above 4 inches made a difference of 2.8 bu. per acre. This means a difference of $70,000,000 for this inch of rain.

When the rainfall for July averaged less than 3.4 inches, the yield of corn averaged 10 bu. per acre less than when the fall was more than 4.4 inches. This makes a difference of about $250,000,000 in the corn crop.

These results have held true for a long series of years, and as the territory considered is large, should hold true in a large measure for the future.

WHAT IS A PLACER?

A placer is an unconsolidated deposit accumulated by mechanical processes, carrying one or more minerals in commercial quantities. All placers are secondary deposits—that is, the material of which they are composed was originally derived by erosion of bedrock. Although it is undoubtedly true that under certain conditions nuggets of placer gold have been enlarged through chemical precipitation, yet this action is a negligible quantity in placers. Placers may be derived solely by rock weathering without water sorting, but more commonly are the result of water transportation, sorting, and deposition. Many of the richest placers are those formed by the erosion of older placers and the reconcentration of their gold.

THE RIO THEODORO, COLONEL ROOSEVELT'S NEW RIVER

By J. Paul Goode
University of Chicago

THE ordinary map of South America, even as given in the better atlases, does not suggest any large uncertainties in the details of drainage. The rivers *look* natural enough, and are supplied with what seems like ample systems of tributaries. Yet in the most carefully made maps, such as those in the large atlases of Andree or Debes, one finds significant open spaces between some of the larger tributaries of the Amazon marked "unerforscht" (unexplored), and with the tell-tale dotted lines of uncertain drainage.

It was through the heart of the largest of these blank spaces that the famous expedition of Colonel Roosevelt journeyed a year ago. And this expedition gave the world a new great river, which carries more water than the Hoang Ho, perhaps three times as much water as the Rhine, a river almost as long as the Ohio River, through a hitherto unknown area larger than the state of Nevada.

How Colonel Roosevelt found the opportunity of coupling his name with this river, is in itself an interesting bit of geography. The river runs through the heart of the great plateau of Matto Grosso, a region of high rainfall, and dense tropical forest, a region where the rubber trees are found at their best. Now the demand for rubber in the world has been increasing by leaps and bounds; and all the rubber lands easily reached along the lower courses of the tributaries of the Amazon being occupied, the rubber men were pushing up every lesser tributary, farther and farther into the wilderness, and the plateau margin along the Madeira River came to be the richest and most promising of the new rubber fields.

The Brazilian government is very much alive in its wish to develop these new great states of Matto Grosso, Amazonas and Acré. The region of the plateau is seriously handicapped, in that its northward flowing rivers are much interrupted by rapids and falls, making river navigation quite impossible. So a great plan has been adopted of connecting this plateau by rail with the nearest Atlantic port of Sao Paulo. Much of the line is built from the southern end, and in the past half dozen years the engineers of the army have been pushing the surveys to the northwest, and laying an advance telegraph line to the falls of San Antonio on the Madeira River. The officer in charge of these surveys was Colonel Candido Rondon, and his work in the years 1907 to 1909 covered a wide tract in the western extension of the plateau of Matto Grosso.

The work of this survey is of very great significance, in that it has given us definite information about the drainage, in place of hearsay, or even conjectural drainage, which has found its way even into the best of maps. The first publication* of this survey, outside of Brazil, shows how great a change there is in the position and tributaries of a large river, the Gy-Parana, and also

*Petermann's Mitteilungen, 1910, pp. 260-261, with map, Tafel 47.

of the head waters of the Tapajos River, and puts a shadow of doubt over the existing maps of the entire region.

When Colonel Rondon left his work in this region in 1909, he had not only made over the map of the Gy-Parana, and its basin, but also that of a large part of the basin of the upper Tapajos River. And between these two basins he had traced the head waters of another group of rivers, which, con-

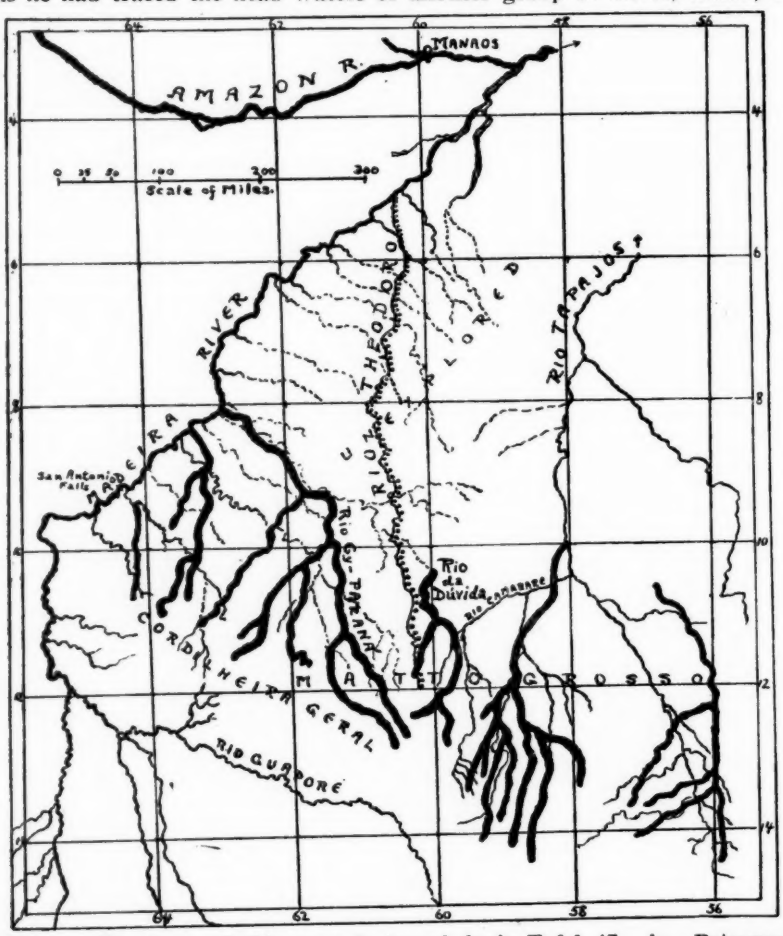


Fig. 1. The base of this map is traced from Tafel 47, in Petermann's Mittelungen, 1910, to accompany note on pages 260-261. It is a preliminary sketch map, over printed in red to show the new drainage mapped by Col. Rondon. The Rio Theodoro, shown by the row of dots alongside, is constructed from the excellent map on a scale of 1:2000000, given by Joerg in Bull. Am. Geog. Soc., May, 1915, facing p. 262. It will be noticed that the Rio da Duvida of the Petermann sketch does not integrate with the refined survey of the Rio Theodoro.

verging toward the north, gave promise of a large river, but offered no clue as to what basin its waters were to be added to. On the accompanying map, which is copied from the article referred to in Petermann, the drainage as shown in the best maps is given in light lines, and the drainage as reconstructed by Col. Rondon, is shown in very heavy, smooth lines. The main

river in the new basin might bend to the east and join the Tapajos; or it might bend to the west and add itself to the Gy-Parana; or it might reach farther northwest and add itself to the Madeira; or it might even reach still farther north and join the Amazon in some of the little known bayous along its course. Because of all these uncertainties, Col. Rondon called it, on his own map, the Rio da Duvida, that is, the River of Doubt.

Colonel Roosevelt, having invitations for addresses from several cities in the South, wished to return over a new route, through the wilderness, and hunt and collect museum specimens of the forest life. Mr. Lauro Mueller, the eminent secretary of foreign affairs of Brazil, called his attention to this unknown river, as good "game" in itself, and Mr. Roosevelt was glad of the "opening." So the Brazilian government sent Col. Rondon with a corps of army engineers, to co-operate with Colonel Roosevelt in following this river to its mouth, and putting it on the map; and the venture was officially called the "Expediciao Scientifica Roosevelt-Rondon."

The results of this venture all the world now knows, and every geography student and teacher will enjoy immensely reading the intensely interesting story of it in the account given by the senior commander himself.*

The river as now known, trends almost due north from the place where Col. Rondon left it, as the Rio da Duvida in 1909, and proves to be a great river, the largest tributary of the Madeira, perhaps nearly a thousand miles long. Col. Rondon, his first assistant Lieut. Lyra, and Kermit Roosevelt made a detailed survey of the river through its whole course. Latitude observations were made at each half degree of latitude, and the positions taken have been coupled up with astronomically proved stations near the source and near the mouth. Doubtless no river of equal size has ever been so accurately mapped in its first navigation.

In the accompanying map (p. 8) the position of the new river is indicated, beyond the point reached by Col. Rondon in 1909, by a line with dots alongside. One may see from this, how very much the drainage established by the actual survey differs from that given in the earlier maps.

Col. Rondon was authorized by the Brazilian government to name the river, if it turned out to be a large one, in honor of Colonel Roosevelt. So when they reached the mouth of the river, a monument was erected, and the river formally christened Rio Roosevelt. But when the survey data reached Rio de Janeiro, the government felt that Mr. Roosevelt's christian name, in the Portuguese form, would be a more appropriate form than the unfamiliar and foreign sounding name Roosevelt. So it goes down on the map for all time as Rio Theodoro**.

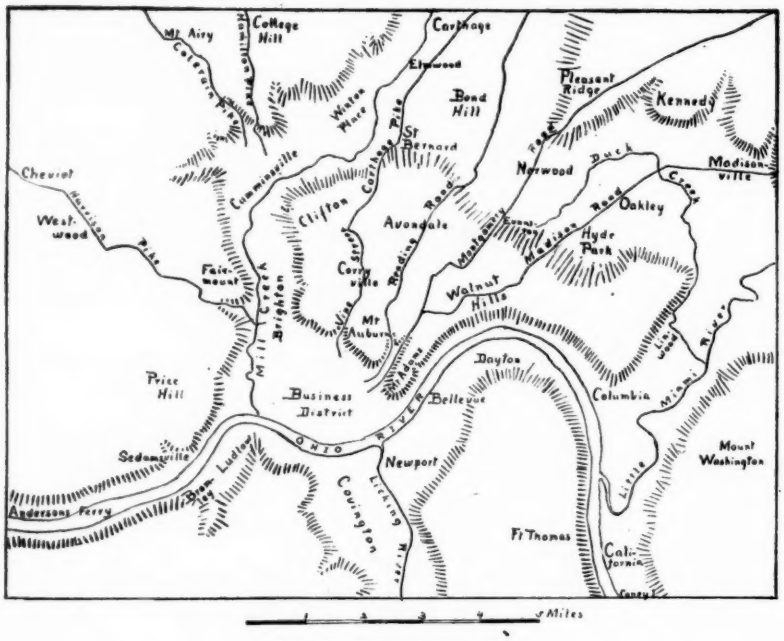
*Roosevelt, Theodore; Through the Brazilian Wilderness; N. Y. Scribners, 1914. 80. pp. XIV+383. Maps and illustrations.

**Some confusion has been introduced by the press, in the form of the name. It was first printed in the Spanish form, Rio Teodoro, with an accent over the "e" which does not belong in the Spanish name. Nor is there any accent used in the Portuguese form Rio Theodoro. See W. L. G. J. in *Bull. Am. Geog. Soc.*, July, 1914, pp. 512-519; also *Geographical Journal*, Feb. 1915, with a very detailed map on a scale, 1/400000; also a note in *Bull. Am. Geog. Soc.*, May 1915, pp. 361-362, and a fine map on a scale of 1/2000000. See also Joerg. W. L. G. "The Geographical Results of the Roosevelt-Rondon Expedition" in the American Museum Journal, March 1915, pp. 129-132, with maps.

THE SITE OF CINCINNATI

By N. M. Fenneman
University of Cincinnati

SURROUNDING region. North of Cincinnati for several hundred miles extends a once forested, nearly flat plain, being cut into hills only near the larger streams. It is the eastward extension of the chief farming district of the United States. To the south for an equal distance is a hilly country surrounding the Blue Grass Region, an oval area 40 to 60 miles in diameter with a mildly rolling surface and very fertile soil. The forests of these areas (containing much hickory) once made Cincinnati a leading center of buggy manufacture. The start thus given has still left it an important hardwood market. First the mast (acorns, etc.) and later the corn raised in this region made Cincinnati a center of pork production. In a similar way the grain made it in early times a center of flour and whiskey manufacture.



SITE OF CINCINNATI

Communications. The Ohio is a natural highway, part of a 10,000 mile system. It is here crossed by a natural north-south land route, the Licking Valley to the south and Mill Creek and Miami Valleys to the north. This line of valleys caused, in succession, a concentration of Indian trails, wagon roads, canals and railroads. No other equally favorable north-south route crosses the Ohio.

Within the area adjoining Cincinnati there is little of mineral resource except building stone for home use, but the presence of the Ohio makes coal

transportation so cheap and easy that they may be regarded as part of our environment.

Site. A low plateau about 900 feet above sea level, is here trenched by the Ohio to 430 feet above sea level. This trench has steep bluffs generally less than a mile apart, but at this point more than 2 miles apart. The Little Miami, Mill Creek and Duck Creek occupy much broader trenches, made before the glacial period when the chief streams followed different lines from those of the present. The bluffs of all these great trenches are cut into hills by ravines, or by valleys which began as gullies and ravines. Back a few miles from the bluffs the upland is nearly level.

Within these great trenches are terraces of sand and gravel. On such a terrace, several miles wide, stands the business section of Cincinnati 100 feet above the river, but still 300 feet below the adjacent uplands of the residence sections, and separated from them by the bluffs which here swing far back from the river. As elsewhere, these bluffs are scalloped by side valleys which subdivide the adjacent upland.

Influence of environment. These features of the site are the cause of much that is distinctive in the plan of Cincinnati and in its daily life, public and private. The first roads to distant villages ascended to the upland by following the side valleys. Thus were determined Gilbert Avenue (Montgomery Road and Madison Road), Reading Road, Vine street (Carthage Pike) and Harrison Avenue, all shown on the accompanying map. The villages of Walnut Hills, Avondale, Corryville and Westwood grew up along these roads. The slope of the steep bluffs overlooking the city has almost prohibited road-making, with the result that these have been but sparingly occupied by homes of a humble sort. Traffic up and down these slopes is by inclines.

One of the distinctive features of Cincinnati is its origin in a great number of independent communities or villages, each occupying its own hilltop, like Clifton, Mt. Auburn, Mt. Adams, Walnut Hills, Price Hill or Westwood, or more or less isolated in valleys like Cumminsville, Brighton, Columbia and Norwood (a separate corporation). An inheritance from this condition of separate communities is the large number (40 or more) of local Improvement or Welfare Associations which are now so important in forming and expressing public sentiment.

Another influence of the peculiar topography is found in the extraordinary number of large and beautiful private grounds surrounding suburban homes. Above and beyond the bluffs there was no lack of room, but much of the area was dissected by ravines, making it difficult to construct streets, without which small lots could not be laid out. Even now the city embraces much unimproved ground of this character. With increasing density of population, new streets have been graded and many of the old homesteads have been subdivided.

The peculiar character of the city's parks is determined by the same principles. Eden Park and Burnet Woods and the university campus occupy areas of exceptionally deep and beautiful ravines (some of which have been leveled up at great expense to the city). The ultimate park plan includes the steep slopes of the now unsightly bluffs, an opportunity almost unique among cities.

The flat portion of the city east of Mill Creek Valley (about 4 square miles) is still far too large to be used exclusively for business. As a residence district it is decadent. The price of ground is however much too high to admit of private yards. Much of this area is therefore occupied by buildings 2 to 4 stories high, the first floor being used for small stores and shops and the upper floors for homes. Residence is much congested in these parts of the city. At the same time the business of the city is greatly congested on narrow streets within a small district having no natural limits. The streets within this district are among the most crowded city streets in the United States. It would be far better in the next 100 years to fill the basin with business blocks from six to ten stories high, and thus displace the poorer tenement quarters, than to line a few narrow streets with sky-scrapers.

Completely encircling the city is a strip of low ground, the Ohio, Little Miami, Duck Creek and Mill Creek Valleys. Manufacturing tends more and more to occupy this low strip. The railroads are necessarily there also. The lower part of Mill Creek Valley, in part occupied by railroads and factories and in part waste ground, affords a natural site for a great harbor.

WELLS MORE THAN A MILE DEEP

The deepest well in the world is in South Africa, over 8000 feet deep; another deep well is in Upper Silesia, in the German Empire, 7,350 feet deep. A well in the United States which may go deeper according to the United States Geological Survey, is about 15 miles west of Pittsburg. This well was 7,174 feet deep in June. Some gas and oil were struck in the upper part of the well. Between the depths of 6,830 and 7,100 feet rocks bearing rock salt and salt water were encountered. The temperature in this well at the depth of 6,775 feet, as recently determined with great accuracy, is 145.8 degrees Fahrenheit.

At Derrick City, McKean County, Pa., near Bradford, there is a well 5,820 feet deep, which is probably the second deepest well in the United States. Another deep well is in Kanawha County, W. Va.; it is 5,595 feet deep. Deep well drillers in this country of course employ the most improved and effective rigs, but one of the most remarkable of wells, reaching a depth of 3,600 feet, was drilled for petroleum in western China by means of such crude appliances as a cable made of twisted strands of rattan.

GEOGRAPHY IN THE ST. LOUIS ELEMENTARY SCHOOLS

A Report of Progress by the Chairman of the Sub-Committee

W. J. Stevens

IN September, 1913, Mr. Blewett, Superintendent of Schools of St. Louis, appointed a general committee and about twenty sub-committees to examine the course of study in the elementary schools with a view to recommending revisions, if it were deemed necessary, and to formulate reasons for such revisions.

The general committee took for its work (1) the formulation of the principles that should determine what ought to be found in the course, (2) the receiving and discussing of the preliminary reports of the sub-committees, and (3) the final action upon the completed reports of these committees.

To the sub-committees were given the task of determining the content of the course in each subject, maxima and minima, and recommendations as to time of introduction of the study, time allotment, and method of presentation. These sub-committees were to present a preliminary report to the general committee for joint consideration and discussion, and, after amendments and suggestions, were to prepare a final report.

The committee on geography began its work in the spring of 1914 by making an examination and comparison of the work attempted in this subject in various sections of the country with a view to determining the content and time allotment. The committee also sent out a questionaire to representative men and women in various professions and industrial and commercial enterprises to get their opinion as to the value of geography in their respective vocations.

The study of the courses in geography in the various cities had some surprises, and indicated a greater range in the kind and amount of attention given to geography than in any other of the common branches. It was found that some schools introduce the subject in the first grade, the majority in the third grade, a considerable number in the fourth grade and a few do not begin the subject until the fifth grade is reached. The time allotment also varies greatly as the following indicates:

Class-hours given to geography in the grades—

City	Total hours	City	Total hours
Boston	690	Tacoma	542
Worcester	665	Chicago	510
Cincinnati	660	New York	495
Rochester	644	Pittsburg	490
Jersey City	630	St. Louis	367
Syracuse	580		

The answers to the questionaire indicated that few employers or managers of commercial or industrial enterprises regard geography as of specific

and direct value as a preparation for the vocations. Its chief value, which most recognize, is its service in developing a greater degree of intelligence and hence its contribution to preparation for any vocation where intelligence is of special value.

The committee on geography has submitted its preliminary report in which it recommends that the subject be begun in the third grade and that there be an inductive study in the third and fourth grades. They advise that this study be organized largely about the subjects food, clothing, shelter, and transportation. They accept the definition, as a working guide, that *geography is primarily a study of the relationship between man and his environment.* They maintain that its study requires:

1. A consideration of two classes of facts, (1) those relating to the life and activities of man, and (2) those relating to his physical environment—earth, water, air, plants, animals.

2. The natural interests of children in living things determines the point of departure, man and his needs. This involves:

(a) A consideration of the material needs of man—food, clothing and shelter.

(b) A study of the means of increasing and satisfying his social relations through travel and transportation.

(c) A consideration of the relation of the social institutions of vocation and government to his development and needs.

3. The earth is man's home. Its land surface, waters and the conditions of the atmosphere affect him. They modify his life through the calls they make upon his energy. Through his efforts he overcomes them and makes them minister to his needs. Hence the relation of man and the earth is one of mutual interdependence. Geography must make this clear. This necessitates some study of the products of the fields, mineral products, animal life, natural phenomena, and a proper development of his ideas of place.

The committee recommends that in the third grade, geography be taught without a text-book. It has prepared a detailed syllabus of the work for the guidance of teachers. The experiment of using the syllabus is being made in some of the schools before the final recommendations of its adoption are made.

The committee advises that the fourth grade include the inductive study of St. Louis, Missouri, and United States. The pupils are to have a text-book, although the course will not be guided by this book, but, rather, by the syllabus and the teacher. The text becomes the source of information through its maps, pictures, and scattered statements. Supplementary readers are to be used freely, the material to be selected by the aid of the tables of contents and the indexes. Consecutive readings are not recommended except in reviews.

As an indication of the method of study in this grade, a part of the syllabus is here given.

Fourth Grade Geography, Inductive Development

St. Louis

I. Industries for which people gather in St. Louis

A. Manufacturing and commerce. (Definition of factory, manufacture, raw materials, products)

1. Things needed for factory work
   a. Raw materials of some St. Louis factories. (If factories are near school, study them.) Leather for shoes, harness, saddles; iron for stoves, car wheels; steel for tools and street cars; wheat for flour, bread, cakes; tobacco leaves for tobacco products; lumber for cars, furniture, houses, doors, windows and frames; cloth for clothing; barley for beer; brick and stone for buildings.
   b. Buildings in which to work
   c. Power to run the machines
   d. Men to do all kinds of work
   e. Ways to carry goods
      (a) Street cars, auto trucks and horse trucks in the city
      (b) Railroads and river steamers to and from St. Louis
      Trace railroads on map of Missouri from St. Louis as a center. Show use of Mississippi River.
   f. Money with which to buy materials and coal, to build buildings and pay freight
2. Sources of some materials. (In order to get the idea of relations to other places. Point out regions on map of U. S.)
   a. Iron from the Great Lakes region
   b. Leather from Chicago and the East
   c. Wheat from Missouri, Kansas and the North West
   d. Lumber from the Great Lakes States, Arkansas, Louisiana, and the South
   e. Cattle and hogs from all the country around
   f. Cloth from the East
   g. Tobacco from Kentucky
   h. Zinc and lead from Missouri
   i. Coal from Illinois
3. Why St. Louis can get these things easily
   a. Central location (Use map.)
   b. Coal near in Illinois
   c. Many railroads
   d. Rivers—much used before railroads and still used for coal, lumber, and bulky freight
   e. Men—many in St. Louis since so much work is to be done
   f. Money. Men bring it where it can be used. Much is received from the sale of products

4. St. Louis as a distributing point
   a. Wholesale stores; traveling salesmen
   b. Buying goods in other cities; goods needed in the trade territory of St. Louis
   c. Factory needs
   d. Grain elevators

B. Needs of St. Louis. (Dependence upon other cities, upon Missouri, and on surrounding states.)
1. Food: wheat, corn, fruit, vegetables, meat, milk, eggs. The farmer, the manufacturer, the railroads
2. Clothing: wool, cotton, silk, leather
3. Shelter: lumber, stone, brick, iron
4. Market: people to buy its goods
5. Raw materials (Trace from source to St. Louis).

Missouri

I. People and occupations outside of St. Louis
A. Country life and occupations
1. Farming: (agriculture, including stock farms, dairy farms, truck gardens near St. Louis, fruit farms)
   a. Parts of the state having many farms and people on account of
      (a) Surface: gentle slopes, good drainage, few rocks at surface, scenery
      (b) Soil: rich in plant food
      (c) Long, warm summers and plenty of rain
   b. Parts of state having few farms and people on account of
      (a) Surface: steep, rocky slopes. (In such regions only valleys along the streams have rich soil.) Free use of maps and pictures to learn this.

B. Town and village life and occupations
1. Relations of farmers and people of towns; mutual services
2. Towns and railroads

C. Other cities of Missouri
1. Kansas City, St. Joseph, Hannibal
   a. Location on an outline map showing the Mississippi, Missouri, and Meramec Rivers
   b. Centers similar to St. Louis as to occupations; Kansas City and St. Joseph prominent in meat and flour industries because of location
2. Joplin and Carthage; location center of special industry of lead and zinc mining
3. No large cities and fewer towns in rough parts of southeast and south-central; some lead and zinc mines
4. Jefferson City, capital.

United States

I. Development of general ideas of the United States from maps and globe

A. Position: on globe and in North America; in temperate zone; teach zones without teaching causes

B. Size, shape, and surface

1. On an outline map that shows state lines, color Missouri.
2. Journey from St. Louis easterly, westerly, northerly, and southerly to the limits of the United States. Scenery including great rivers, great plains, highlands, mountain ranges. On these journeys learn Atlantic and Gulf plains; Appalachian highlands; great central plain, including Great Lakes, valleys of the Mississippi, Ohio, and Missouri rivers; the Western highlands including the Rocky Mountains, Sierra Nevada, Cascade, and Coast ranges.

II. Some foods of the United States

1. Wheat map. Write names of states prominent in wheat growing and color same.
2. Physical map, for surface and soil
3. Rainfall map for rainfall
4. Text and supplementary readers for conditions required and fulfilled in wheat growing regions
5. Names and locations on map of greatest wheat growing states
6. Relation of Missouri to wheat raising
7. Farming processes; seasons, pictures
8. Shipping needs: include elevators, railways and Great Lakes; pictures
9. Manufacturing. Locate and find advantages of Minneapolis, Chicago, St. Louis, Indianapolis.
10. Export of surplus

Note: Wheat is grown more or less in all states of the northern region, also in Washington, Oregon and California. Avoid impression that it is grown in limited regions but put stress upon great regions.

B. Potatoes

1. to 4. Treat somewhat as in discussion of wheat.
5. Notice correspondence with wheat states: Missouri and potato growing
6. Farming processes
7. Shipping needs

C. Vegetables

1. Relation between truck gardens and cities; scattered industry
2. Sources of vegetables in the north in winter and early spring
3. Advantages of transportation
   a. Refrigerator cars

b. Favorable location, available markets; North Carolina, Florida, Arkansas, Texas

4. Manufacturing
   a. The canning and pickling industry
   b. Regions: New Jersey, Delaware, Maryland, Pittsburg, Baltimore

D. Fruits
1. Oranges, lemons, grape fruit
   a. Localities: from supplementary readers and text
   b. Climate of regions, as suitable for producing
      (a) Heat conditions
      (b) Moisture conditions
      in Florida
      in California (Irrigation)
   c. Shipping needs; refrigerator cars
   d. Shipping points, Jacksonville, Los Angeles
2. Apples, peaches, grapes, strawberries
   a. Localities: Delaware, New York, Maryland, Ohio, Georgia, Michigan, Illinois, Missouri, Colorado, California, Oregon, Washington
   b. Climates; contrast with conditions necessary for citrus fruits
      (a) Heat and moisture conditions
      (b) Irrigation
   c. Relation to truck gardens

E. Meats
1. Ranch products
   a. Grazing regions; great plains and western highlands
      (a) Character of surface
      (b) Rainfall
   b. Conditions favoring herding rather than farming
   c. States
      (a) Highland: Montana, Wyoming, Idaho, Colorado, New Mexico, Oregon
      (b) Great plains: Kansas, Nebraska, Dakotas, Oklahoma, Texas
   d. Work of herding cattle and sheep; show pictures.
   e. Shipping needs
   f. Manufacturing
      (a) Centers and advantages; Omaha, St. Joseph, Kansas City, Chicago
      (b) Dressing and canning
      (c) By-products: hides, tallow, glue, fertilizers
2. Stock-farm products: cattle, sheep, hogs
   a. Location in regard to farming: corn belt, oats belt, hay states
   b. Location in regard to rainfall
   c. Location in regard to farm crops

(a) Feed in summer and winter
(b) Use of poor land and woodland for pasture
d. Locations for sheep contrasted with those for cattle and hogs
e. Relative importance of stock farms and ranches in supply

F. Dairy products
1. Milk: location as influenced by cities; widely scattered
2. Butter and cheese: New York, Ohio, Illinois, Wisconsin
3. Relation to farm crops
4. The creamery and cheese factory, a country town industry

G. Sugar cane and rice
1. Location, Gulf plains
2. Surface and soil
3. Rainfall and temperature
4. Special requirements for rice
5. States: Louisiana, Texas, South Carolina, Arkansas
6. Farming processes; special features; negro labor; the sugar mill
7. Manufacture of sugar; New York refineries

H. Beet sugar: Michigan, California, Colorado using irrigation

I. Fish
1. Localities
a. North Atlantic coast, cod, halibut, mackerel
b. Gulf coast
c. Great Lakes; trout, whitefish
d. Pacific coast, salmon
2. Conditions (Text and supplementary readers.)
3. Shipping: fresh
4. Manufacturing: salting, drying, smoking, canning
5. Centers: Boston, Baltimore, Portland
6. States: Washington, Oregon, Maryland, Massachusetts

J. Oysters: localities
1. New England coast, Long Island Sound
2. Chesapeake Bay
3. Shipping; fresh
4. Manufacture: canning
5. Centers: New York, Baltimore

K. Salt
1. Localities: New York, Michigan
2. Conditions
3. Process (Brief.)
4. Importance in manufacture of salt fish and meats.

CONDITIONS IN CHINA

From the Annual Report of the (British) China Association, 1914-15.—*Jour. Am. Asiatic Assn.*

"The Republic has justified its existence in a remarkably short space of time. It has re-established the authority of Peking over the Provinces, has to a great extent suppressed disorder, and has inaugurated judicious fiscal reforms on conservative lines, as, for example, in the case of the Salt Gabelle.

There is an element of weakness in the present system of government in that it is mainly dependent on one man—the President—but the country may count itself extremely fortunate, while it has been passing through a period of violent upheaval, in having a strong man to direct the course of affairs; a weak leader, even with the best intentions, might easily have landed the whole country in anarchy. China has the good fortune, at this crisis in her affairs, to have a leader who not only knows his own mind, but also knows his fellow countrymen, who has decision of character and the courage of his opinions.

It is clear, however, that there is a great element of danger in any system of government which is dependent on any individual however eminent and capable."

J. O. P. Bland in the Atlantic Monthly.

"For the present, it is sufficient to observe that the great-man theory of government has once more been vindicated in China, and that, at a time when all the western world lies under heavy storm-clouds of war, the Celestial Republic shows signs of successfully emerging from some of the most grievous troubles of its internal disorganization. Yuan Shih-k'ai's recent mandates are an intimation to the world in general, and to Young China in particular, that the ends of autocracy have justified its means, some of which have been undeniably "frightful," and that, political agitation being barred as a means of livelihood at Peking, benevolent despotism is in a position to protect the state from the dangers which have so long threatened it from within. Of those which threaten it from without, this is not the time or place to speak; but, given a solvent exchequer and a little luck, the Velvet Glove should be able to deal with them also."

Excerpts from J. D. Whelpley's Article "East and West" in the Fortnightly Review

The serious error in Western thought and utterance concerning the China of today is the assumption that the China of yesterday has, by some hocus-pocus on the part of the revolutionists, been sent into retirement with the Manchu dynasty. There has been a substitution of rulers at Peking, pledged to different things, but the only successes recorded of their administration have been accomplished along lines familiar to Chinese politics and government for many generations past.

"The changes to take place in China will come slowly, and will be measured by the mileage of new railroads constructed. The doing away with treaty ports, the safety of the whole country for foreigners, the establishment of a national currency and banking system, the building up of strong and just local governments, a corruption-free administration in Peking, an effective fiscal system, a strong cohesive army and navy—these are things yet to come, and the road is long and full of obstacles. In the meantime, the strength of character and singleness of purpose of the Chinese people is a guarantee of the continued immutability of the nation. It is an elusive quality, this strength of Chinese character, one difficult to define, yet deeply felt by every Westerner who associates with them. The Occidental who lives many years in China never makes much headway against it. In most cases he is swamped in the depths of Orientalism. In nearly every other country where the white race has established itself among an alien population it becomes the dominant force. The white men tower above their surroundings, and are the acknowledged superiors, in authority at least, of those about them. This is not the case in China."

"The struggle for existence is the single purpose of the Chinese, and it is a struggle the cruelty and terror of which are hard to realize. They are a peaceful people, intent upon their own ends. Ghastly disasters and a terrible mortality from natural causes have so cheapened life that it counts as nothing. The country itself is ugly and commonplace to the eye, and the life of the mass of the people is sordid to an extreme. Away from the treaty ports, and out of sight of Peking, it matters not who rules the State. The work of the Chinese people is to get enough to eat, to weave on hand looms the nearly £200,000,000 worth of cloth, not imported or produced by Chinese mills, needed to clothe over four hundred million people. Great cities are lacking even in wagon-road communication with other communities. It is in these great centers of population that the mass of the people live. It is from the surrounding land that food is secured by scrupulously returning to the time-worn soil every ounce of refuse, animal and human, that its fertility may be kept at producing point."

"There is one nation that does understand China, and that is Japan. With a sympathetic mental outlook and an avowed purpose to grow great through the wealth and necessities of her vast neighbor, Japan has set herself the task of dominating the affairs of the Far East—or, in other words, to secure the best that is to be had in that part of the world for her own people."

"In the meantime, Japan progresses apace towards the goal of her ambition. Long ago her statesmen abandoned all thoughts of the Philippines, for they had proved unfavorable to Japanese settlement. There is no thought of real war with the United States, for there is too little to be gained. Everything points to a plain path for the future, the farming of China territorially and for commercial gain. It is a natural and logical outlet for Japanese energies, and no country is better fitted for this campaign. There are a hun-

dred thousand Japanese now resident in China. They speak the language, adopt the manners and customs of the Chinese, and cater to their wants with a shrewdness and completeness unknown to traders of other nationalities."

"Japan is a great Power today, and is to become greater, for she has no serious rival in that part of the world over which her sway is to be extended. It is with Japan that the West will be compelled to treat in the final settlement of all Far Eastern affairs; for with a power and supremacy which cannot be challenged, her statesmen have good reason to feel sure of their ground. Japan is even now the Dictator of the Orient."

From the North China Daliy News

To any great extent, however, Chinese unity in the political sense was almost an impossibility. When intercourse was a matter of days, weeks, or months, simultaneous action was an impossibility. Moreover, there was never a time since the abdiction of K'ien Lung in 1796 when the weakness of the Central Government was not a stimulus to rebellion. The provinces became a law to themselves. They armed for their own defence. They had their own little navies if they happened to be placed on the Great River or the coast. They sometimes fought for their own hand, like Hal o' the Wynd, but they would not fight for each other. How far things have changed at this present time is becoming more and more apparent. Without going so far as to say that provincial particularism is a thing of the past, we may safely declare that the growing solidarity of the country is such as most to astonish those who have lived longest in it. How it has come about is simple enough. For men to be brought together politically, industrially, or otherwise, easy means of communication are a *sine qua non*. These have to some extent been developed. We have had steam on the coast and the rivers for many years. Now there are thousands of miles of railways, and tens of thousands of miles of telegraph wires. Greater in effect even than these, there is the power of a ubiquitous newspaper press, slightly separatist at times, but as a rule tending to consolidation. Politically even greater changes have taken place. The Manchus have gone, never to return, and with them the greatest of all disruptive agencies. The first republicans, too, have disappeared to a large extent, and with them the crudest of their mistaken, if well-meant innovations. So that at the moment we see the capital and the country ruled by an administration composed of an admixture of conservative and progressive elements, precisely the kind of combination likely to commend itself to the awakened mind of a great people like the Chinese. The past is not forgotten, and the present is busily engaged in laying upon it the foundations of the future. The fear expressed by radicals that China is falling back into the slough of the past is hardly worth a thought. It is impossible for China to go back. Every token shown by recent experience points to progress. Note especially the success of such reforms as that of the Salt Gabelle. Most particularly of all, the recent financial successes should be given their full weight. The success-

ful raising of internal loans means even more in China than in other lands, and we have seen what that success has been. We have seen a reorganization of military strength, and the disappearance of rebellion before it, and last, but not least, we are now witnessing the effect of pressure by Japan. From Canton to Manchuria, from the coast to Szechuan, there are signs that China the Dispersed and Disembodied, has become China the United, a stepping-stone to China the Strong.

CURRENT MATERIAL FOR THE GEOGRAPHY TEACHER

Rice Cultivation in the United States

Irrigation is a necessity in profitable rice culture, except in favored localities whose seasonal rainfall is very high. In general, therefore, a plentiful and easily accessible water supply is the first requisite where rice is to be grown. Rice thrives best in a warm, humid climate. A growing season of at least 135 days and a rich loam or clay soil level enough to permit economical irrigation, underlain by a tight formation through which water will not percolate readily, are other conditions only second in importance to the water supply, if the crop is to be produced on a profitable scale. These combined conditions are found in various sections along the South Atlantic coast, on the prairies of southwestern Louisiana, southeastern Texas, eastern Arkansas, and the alluvial lands along the Mississippi River and its tributaries in those States and in Mississippi.

Almost the whole of the present rice crop of the United States is grown in the sections named, although rice fields now being developed in the Sacramento Valley of California may soon add a considerable area to the acreage devoted to this crop. For many years the Carolina rice fields produced nearly all the rice grown in the United States, but the Civil War greatly injured the industry; by far the larger part of the rice crop of the United States is now produced on the prairie lands of Louisiana, Texas, and Arkansas. The industry is new in California, but promises to become of much importance in certain sections of that State, especially in the Sacramento Valley, where water is secured for irrigation by gravity flow or by pumping from streams.

In the three principal rice-growing States—Louisiana, Texas, and Arkansas—all but 2.5 per cent of the irrigated land in rice is supplied with water by pumping, and wells afford a supply for about one-third of this area. Some of the largest and best-equipped pumping plants in the world are located along the streams of southwestern Louisiana and southeastern Texas for use in rice irrigation.—[*U. S. Dept. Agr. Farmers' Bulletin* 673.]

Traffic on American Rivers

That river traffic in the United States is now generally local, and long runs by through fast steamers a thing of the past, is shown by an investigation of water transportation in this country which the United States Depart-

ment of Agriculture has just completed. The results of the investigation have been published under the title of "Inland Boat Service," a bulletin that deals in particular with freight rates, time of transit and length of routes.

A few hundred miles, the investigator found, is usually the maximum run for any steamboat, one of 400 miles or more being more exceptional. On only 25 of the 102 routes for which this information was available, was the average rate of speed over 10 miles an hour and on 37 it was less than six. An average of 10 or even six miles an hour amounts to 75 or 100 miles in a night's run, which is a good rate of speed for local freight traffic.

In the East, the principal routes of steamboat lines include those of the Hudson River and the Chesapeake Bay. On the Hudson there is considerable variety of traffic—through service between New York City and Albany, a number of shorter routes between various cities along this line, and, thirdly, the through traffic of canal boats carrying cargoes from the Erie Canal to tidewater. In Chesapeake Bay, traffic radiates principally from the cities of Baltimore, Washington and Norfolk. Through service between Baltimore and Norfolk, Baltimore and Philadelphia, Norfolk and Washington, and Norfolk and Richmond is maintained throughout the year.

The longest routes are to be found in the Mississippi Valley. From Cincinnati, for example, regular lines run down the Ohio and Mississippi Rivers as far as Memphis, a distance of 749 miles. Another important river port is St. Louis, from which regular lines run as far in one direction as St. Paul, on the upper Mississippi, and in another, down the river to Memphis. Other lines reach Kansas City, Peoria, Illinois, and mount the Tennessee River as far as Waterloo, Alabama. From Memphis, through boats run to Vicksburg, where they connect with boats for New Orleans.

New Orleans is the center of several important routes in addition to the direct one up to the Mississippi. One line follows the Red and Black Rivers to Harrisonburg, Louisiana, and various other routes traverse the network of rivers, bayous and canals in southern Louisiana as far west as Bayou Teche, and as far north as the Red River. There is also considerable traffic on Lake Pontchartrain.

On the Pacific Coast, an important system of waterways consists of the rivers emptying into San Francisco Bay, and here there is a rich truck region which is not conveniently reached by rail, but is comparatively easy of access by boat. San Francisco, Sacramento and Stockton are the principal centers for this traffic. A second Coast system consists of the Columbia River and its tributaries. From Portland, steamers run down the Columbia to Astoria and up as far as Celilo Falls. Above the Celilo Falls other boats reach points on the upper Columbia and Snake Rivers.—[*Commercial America.*]

The World's Food Harvest of 1915

Much German land formerly used for pasturage, for sugar-beets, and for non-agricultural purposes, has this year been devoted to potatoes, cereals, beans, and garden crops. The total volume of food thus produced will prob-

ably prove much greater than in any former year. The same thing seems to be true of Austria. All reports from Vienna refer to the harvest season in Austria and Hungary as unusually bountiful. The very old, the very young, the women, the war prisoners, the city folks, and the soldiers on furlough have all helped in raising and harvesting the crops.

Very little information has come from France regarding current crops; but France is a farming country and ordinarily produces ample bread materials. This year's supply seems to be on a normal basis. The British Islands never produce food enough for the whole population. They will in one way or another have maintained their average this year, and Germany's submarine campaign has not impaired to any appreciable extent the facility with which England can import all that she needs from North and South America, Australasia, India, and parts of Africa. Stimulated by the high price of wheat and the European demand, American and Canadian farmers increased their acreage of cereals for this season's crop to a very marked extent. The result is that, according to the estimates of the Agricultural Department early in July, the wheat yield of the United States will be far the greatest in the history of the country, going well beyond the unprecedented crop of last year and reaching a total of almost a thousand million bushels. There were, however, in many parts of the country, very bad conditions during the period of the ripening and harvesting of the winter wheat, which will have caused a shrinkage of millions of bushels in the final outcome. In any case, the United States will have a large wheat surplus to export to Europe as needed. The Canadian wheat crop, particularly in Manitoba, Saskatchewan, and Alberta, will be harvested from a greatly increased acreage, but estimates of the total crop, as compared with that of last year, are not as yet to be regarded as sufficiently accurate for final acceptance. It is probable that the crop will go beyond two hundred million bushels, equaling that of the Dakotas and Minnesota.

There has been unwonted agricultural effort in the Empire of the Czar. The Russian wheat crop, accordingly, is reported as the greatest, both in acreage and in yield per acre, that Russia has ever known. It is presumable that rye and barley (the "black bread" cereals) are being harvested in augmented quantities. There is a large surplus of the 1914 crop in the Russian granaries and storehouses. This is partly due to the cutting off of facilities for export, and also in part to the use of the Russian railroads by the government for military purposes. This summer, large amounts will perhaps have gone out by way of Archangel and other northern ports. It is alleged that until within a few weeks past considerable quantities of Russian wheat found their way into Rumania, where they were in part transshipped to Germany.—[From "The Progress of the World," in the *American Review of Reviews* for August.]

THE MISSOURI RIVER

The Missouri is the muddiest river in the Mississippi Valley; it carries more silt than any other large river in the United States except possibly the Rio Grande and the Colorado. For every square mile of country drained it carries downstream 381 tons of dissolved and suspended matter each year. In other words, the river gathers annually from the country that it drains more than 123,000,000 tons of silt and soluble matter, some of which it distributes over the flood plains below to form productive agricultural lands, but most of which finds its way at last to the Gulf of Mexico.

It is by means of data of this kind that geologists compute the rate at which the lands are being eroded away. It has been shown that the Missouri River is lowering the surface of the land drained by it at the rate of 1 foot in 6,036 years. The surface of the United States as a whole is now being worn down at the rate of 1 foot in 9,120 years. It has been estimated that if this erosive action of the streams of the United States could have been concentrated on the Isthmus of Panama it would have dug in 73 days the canal which has just been completed, after 10 years' work, with the most powerful appliances yet devised by man.

Ten States of the Union are drained in part by Missouri River. Rising at the Red Rock Lakes, at an elevation of 6,700 feet above sea level, the Missouri descends through the Rocky Mountains and emerges onto the broad prairie lands a few miles below the city of Great Falls, Mont. Within 10 miles of Great Falls there are five great drops of the river and an aggregate fall of 612 feet. From this point it is accounted a navigable stream with an easy grade, and in passing through the Dakotas and along the borders of Nebraska, Kansas, and Iowa it receives the flow of great tributaries, so that as it crosses the State of Missouri and joins the Mississippi a short distance above St. Louis it becomes one of the large rivers of the world. Its total drainage area is about 492,000 square miles in extent.

On Shoshone River, in Wyoming, a tributary of the Bighorn, which in turn is tributary to the Yellowstone, is located the Shoshone dam, one of the highest of its kind in the world, 328 feet from foundation to capstone. This structure was erected by the Government to impound water for irrigation on the arid lands in the valley of Shoshone River below. Another great structure of a similar kind is located in Wyoming, on North Platte River, which joins the Missouri near Omaha, Nebr. This is known as the Pathfinder dam, and was also erected by the Government to impound water for use in the irrigation of lands in Wyoming and Nebraska. Another notable engineering structure in the drainage basin of Missouri River is the Belle Fourche dam, erected across the river of the same name in South Dakota by the Government to impound water for irrigation. This dam is an earth embankment 155 feet high and 1 1-5 miles long, containing 1,600,000 cubic yards of earth fill. This is one of the greatest earth dams in existence.

NEWS NOTES

One hundred and fifty persons, mostly teachers, were enrolled in the geography courses at the summer session of the University of Wisconsin.

On July first Professor Isaiah Bowman assumed his duties as Director of the American Geographical Society of New York. He also holds the position of Librarian of the society.

Professor N. A. Bengtson's paper on "The Influence of the Transcontinental Highways of the United States on the Price of Wheat," read before the Chicago meeting of the Association of American Geographers, appeared in the June number of *School Science and Mathematics* (Chicago).

One of our former contributing editors, Dr. Charles McMurry, has resigned from his dual position as Superintendent of Schools of DeKalb, Ill., and professor of pedagogy in the state normal school of that city, to accept a new position in the Peabody Teachers' College of Nashville, Tenn.

Mr. V. C. Finch, business manager of the *Journal of Geography,* who has been absent from the University of Wisconsin for several months, engaged in work on the U. S. Dept. of Agriculture's forth-coming "Atlas of Agricultural Geography," will return to his work in the university in September.

E. V. Robinson, professor of Economics, University of Minnesota, has returned from a year of residence and travel in Europe. During his absence he was elected to a professorship of economics in Columbia University, New York.

Mr. George B. Roorbach of the University of Pennsylvania, editor of the *Bulletin of the Philadelphia Geographical Society,* is in Venezuela making a study of the effects of the European war on industrial and commercial conditions in that country. The investigation is being conducted under the auspices of the Carnegie Endowment for the Promotion of International Peace.

The July *National Geographic Magazine* contains a large folded map of Europe, in colors. The magazine's recent practice of including large maps in colors is to be commended. The July number of the *Bulletin of the American Geographical Society* also contains a large folded map in colors,—in this case, of a portion of the Canadian Rockies. The geographical magazines in America are rapidly rising to the high standard attained by the best European magazines. No European magazine compares with the National Geographic in excellence of illustrations, but in the average quality of the geographical

papers the best European magazines are still superior to ours. We know of no European magazine, however, which has a department of "Geographical Literature and Maps" equal to that of the *Bulletin of the American Geographical Society*.

Dr. Wellington Jones and Mr. Carl O. Sauer of the University of Chicago published a valuable "Outline for Field Work in Geography" in the July number of the *Bulletin of the American Geographical Society* (New York). The outline presents the plan under four main heads:

1. Preparation for field work
2. Field methods
3. Field observations
4. Office work after the field season preliminary to writing report.

An important contribution to the science of glacial geology, one of a series of similar reports, is Monograph 53 of the United States Geological Survey, "The Pleistocene of Indiana and Michigan and the History of the Great Lakes," by Frank Leverett and Frank B. Taylor. In this report the authors have continued the description of the glacial deposits and history of the Great Lakes region. Their maps show the relations of the remarkable systems of moraines formed by the glacial lobes which occupied the basins of Lake Michigan, Lake Huron, and Lake Erie.

The Geological Survey has unearthed some copies of the "Catalogue and index of the publications of the Hayden, King, Powell, and Wheeler surveys," the four great Federal surveys whose field work was carried on between 1867 and 1879, when the United States Geological Survey was organized. The publications of these early Government organizations constitute a storehouse of geographic, geologic, ethnologic, and archeologic information concerning the western portion of the United States. The Geological Survey has no copies of the publications of these surveys for distribution, but the index (Bulletin 222) may be obtained on application to the Director, U. S. Geological Survey, Washington, D. C.

RECENT PUBLICATIONS

PRACTICAL EXERCISES IN GEOGRAPHY, by Wm. J. Sutherland and Chester M. Sanford. Silver, Burdette and Co., 196 pp. 1915.

The authors are respectively the president and the head of the department of geography of the Platteville, Wis., Normal School. In this little book, the authors put into concrete form, some of the ideas which President Sutherland has championed in various addresses and papers. The book is based upon the idea that geography in the upper grammar grades is most effectively and most interestingly taught through practical exercises or elemen-

tary laboratory problems to be worked out by the pupils. A text book, reference books, and a note book are required. Book I, which deals with the United States, is to be followed by Book II, dealing with South America and Eurasia. The character of the "problems" is suggested by the following: Why should factories be located at waterfalls? What influence have the rivers of New England had on the development of manufactures? Why is fishing profitable off the coast of New England? Why has fruit growing become the leading industry of Florida? Why is rainfall so meager on the Great Plains west of the 100th meridian? Besides the problems which are to be solved by working up the answers to a series of questions, the book contains text material, general questions and page references to a large number of reference books.

That the authors of this book, both experienced teachers of geography, are working out a highly valuable method of teaching the subject, there is not the least doubt. Every teacher knows that the ordinary text book method of teaching geography has not given results. The laboratory method has been introduced in some high schools and universities with varying degrees of success. Here is an attempt to apply the laboratory method to the grade work. The little book is a praiseworthy endeavor, worked out with thought and good judgment. It deserves to succeed. We shall be much interested to receive reports from teachers who try the method and we hope many will make the trial.

NEW TRANSCONTINENTAL GUIDE-BOOKS

THE United States Geologcial Survey has recently issued a guidebook describing the Overland Route from Missouri River to the Pacific coast, and every traveler may now enjoy the luxury of being "personally conducted" without any other expense than the dollar he must send to the Superintendent of Documents at Washington ,D. C., to obtain a copy. Similar guide books covering the Northern Pacific Route, so closely identified with the Lewis and Clark expedition of 1803-1806, the Santa Fe Route and the Shasta and Coast Route are to follow soon*.

The value of these guides to travelers interested in their country can not be measured. The route is followed from station to station, and the country along the way described and explained from many points of view. Human history, geologic history, agricultural and mining values—everything, in short, that can make a car-window landscape vital and interesting—is succinctly and rapidly sketched. The long stretches of prairie country and endless miles of desert, often so dreary to the uninformed traveler, are made to teem with human interest and scientific information.

The guidebooks are full of items of general interest that will answer such questions as the average intelligent traveler is continually asking. In a broad way the story of the West is a unit, and the aim of this description of

*The Northern Pacific Guide Book and The Traveler's Guide to the Pacific Coast, covering the Shasta Route and Coast Line are now ready for distribution. $1.00 each, Supt. of Documents, Washington, D. C.

the western United States is to meet the needs of the American citizen who desires to understand what he sees.

In the preparation of the book on the Overland Route (Bulletin 612) much information already in the possession of the Geological Survey has been utilized, but to supplement this material three geologists last year made a field examination of the entire route, while special topographic surveys for the accompanying maps were made by Survey engineers. The route is covered by a series of 29 complete and accurate maps, which are so arranged that the reader can unfold them one by one and keep each map in view while he is reading the text relating to the portion of the route it represents.

The book is also freely illustrated with half-tone plates of some of the most striking views and objects to be seen on the journay and with pictures of prehistoric animals that inhabited the West in ages past, when Nebraska and Colorado, for instance, were huge swamps frequented by strange beasts whose fossil remains are now found in the rocks formed from the sand and mud of the ancient swamps, which have since been elevated thousands of feet. The book of 244 pages is as a whole distinctly popular in character. Price $1.00.

LASSEN PEAK BELIEVED TO HAVE SPENT MOST OF ITS ENERGY

LASSEN volcano, California, spent most of its energy in its violent eruptions of last May, according to reports received by the Forest Service, and it is believed that there is little likelihood of further destructive outbreaks. Since the upheavals of May 20 and 22, the volcano has been under the observation of officers of the Lassen National Forest, in which the peak stands, and for the last month a volcanologist of the U. S. Geological Survey has been making a scientific study of the mountain.

The investigations have confirmed the opinion that the eruption of two months ago, when a river of mud was blown out of the north side of the crater and down Hat Creek with considerable damage to Government and private property, was caused by the melting of the snow on the peak, the snow water running into the crater and being converted by the molten lava into steam. Although it is possible that the volcano is simply conserving its energy for another outbreak, the indications are, according to the Government volcanologist on the ground, that no further eruptions are likely to occur, at least until next spring when another influx of snow water may cause a slight disturbance.

The first authentic report of the damage done by the eruptions of last May shows that early reports were greatly exaggerated.

MISCELLANEOUS "WHYS" IN GEOGRAPHY

1. Why do we have alternate day and night?
2. Why do we have change of seasons?
3. Why are there ocean currents?
4. Why are there tides?
5. Why does it rain?
6. Why are there caves?
7. Why are nearly all caves in limestone?
8. Why do rivers flow down hill?
9. Why does dew form in summer nights?
10. Why do clouds gather in the sky?
11. Why is the torrid zone 47° wide?
12. Why is it cold at the poles?
13. Why has the year 365+ days?
14. Why does sinking of the land give an irregular coast?
15. Why are lakes common in most glaciated regions?
16. Why are lakes in stream courses an evidence of youth?
17. Why is the soil usually better in valleys than on hill slopes?
18. Why do the rocks weather more rapidly in mountains than elsewhere?
19. Why are waterfalls in streams an evidence of youth?
20. Why is the bed of the ocean less irregular than the surface of the continents?
21. Why do high mountains cause rainfall?
22. Why is the temperate zone 43° wide?
23. Why do sand-bars form in rivers?
24. Why do they form along some sea coasts?
25. Why are there glaciers in some mountains?
26. Why do glaciers move?
27. Why do rocks decay?
28. Why are flood plains usually fertile?
29. Why do some rivers build deltas?
30. Why do rivers make valleys?
31. Why is an oceanic climate more equable than a continental?
32. Why is a "southern exposure" in our latitude warmer than a northern?
33. Why are the days and nights of equal length over all the earth at the equinoxes?
34. Why does the sun appear to rise in the east?
35. Why is the atmosphere denser at the base of a mountain than at the top?
36. Why does the torrid zone not have seasons like ours?
37. Why is it possible for us to have our winter when the earth is nearest the sun?
38. Why do the equatorial currents of the oceans move toward the west?

NEW AND FORTHCOMING GEOGRAPHICAL MATERIAL

Henry Holt and Co. announce the publication in the near future of a high school Commercial Geography written by Prof. J. Russell Smith of the University of Pennsylvania.

A Brief Laboratory Course in Physical Geography, by Everly, Blount, and Walton, has just been issued by the American Book Co. It is a revision of the earlier manual by the same authors; loose leaf; adapted to a half-year course in high school.

A New Rainfall map of the United States (62x42 inches) has recently been issued by A. J. Nystrom & Co. (Chicago). It is based upon data prepared by Mr. Henry Gannett, shortly before his death. Seven different degrees of rainfall are shown by shades of blue. The same publishers also announce the publication of the Kuhnert Relief-like map of the United States (75x65 inches). This map was printed in Germany but edited in America. It forms one of the Kuhnert Relief-like map series.

A new rainfall map of the United States, by Eugene C. VanCleef, has recently been issued by Rand McNally and Co. (Chicago); size 44x66 inches. The same publishers are announcing a new political map of South America and a new physical map of the world on the Mercator projection, by Professor J. Paul Goode. In the latter map altitudes of 1000, 2000, 5000 and 10,000 feet are shown by differences in coloring. Ocean depths, isotherms, ocean currents, and cities of over 500,000 population are shown.

"Panama and its Bridge of Water," a Geographical Reader by Stella H! Nida. "South America," a Geographical Reader by Professor Iasiah Bowman, and a "True Literary Map of the British Isles," (46″ x 66″) prepared by Blanche L. True, are among the new offerings of Rand, McNally and Co.

The Geological and Natural History Survey of Wisconsin has recently issued—

"Limestone Road Materials of Wisconsin," Bulletin XXXIV, by W. O. Hotchkiss and Edward Steidtmann.

"Mineral Lands of Northern Wisconsin," Bulletin XLIV, by W. O. Hotchkiss, E. F. Bean and E. O. Wheelwright.

"Peat Resources of Wisconsin," Bulletin XLV, by F. W. Huels.

Two additional Bulletins will soon appear: "The Geography of the Fox-Winnebago Valley," by R. H. Whitbeck, and "The Physical Geography of Wisconsin," by Lawrence Martin.